NASA National Aeronautics and Space Administration

1981 Mishap and Injury Data

NASA Safety Division
Office of the Chief Engineer
Washington, D. C. 20546

FOREWORD

This report contains statistical and narrative information concerning NASA and NASA Contractor mishap and injury experience for calendar year 1981. Injury data are reported for full-time NASA civil servants, and injury summaries in the form of NASA form 345's were submitted for contractors at seven centers. Injury/illness frequency and severity rate data are not available from the contractors. However, we have had serious contractor injuries and fatalities during the past year, and more effort will be invested in future years to avoid these losses and bring our contractor safety programs in line with those of our Civil Servants. Quarterly reports will cover our contractors in much the same way they cover our government employees.

This report is designed to assist management at all levels in determining areas for concentration of resources and to advise employees of the status of the NASA safety and health programs.

The number of fire incidents was 20 in 1981, and the costs increased from $57,000 to $800,000. Our aviation flight operations experienced two significant losses costing $195,000, the death of one pilot, and serious injury of another. In addition, two employees were killed during a familiarization flight in an experimental aircraft. The automotive accident frequency rate and monetary losses increased in 1981 compared to 1980, but the losses were still low compared to several recent years. Our frequency rate for government vehicles was 3.94 accidents per million miles driven and 2.24 for private vehicles used for official business, and the reported losses were $11,000 for government vehicles. This is the second time since 1971 that NASA has been within the target of 5.0 accidents per 1,000,000 miles driven for the motor vehicle rate.

Our lost time injury/illness frequency rate decreased from 0.67 to 0.47 per 200,000 hours worked. Seven installations had decreases in their lost time injury/illness frequency rates, and five had decreases in total reportable rates. The NASA severity rate continued to decline and is at its lowest point since 1970. The chargeback billing which the Office of Workers' Compensation Program imposes on NASA for reimbursement increased to $4.2 million, but costs associated with continuation of pay continued to decline since reaching a peak in 1978.

An analysis of our lost time injuries over the last four years indicates that the majority of our accidents are still those normally associated with industrial operations and are not unique to a research organization. This indicates a need to continue to direct emphasis to the occupational safety and health portions of the overall program. The 1982 targets established for each installation in accident prevention are designed to focus attention on occupational safety and health, major mishaps, monetary losses, and recertification of pressure vessels/systems.

The NASA Safety and Health programs have shown improvement in the last few years, and they are expected to continue to improve in the future. The programs compare very favorably to other Federal agencies and private industry. We commend you for your excellent performance during the past year and encourage you to develop new initiatives in the areas of contractor safety and aviation safety in 1982.

J. Larry Crawford
Director of Safety
NASA Headquarters

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NASA PERSONNEL INJURIES FOR 1981

NASA had a 30% decrease in lost time injuries/illnesses in 1981. Three charts compare injury rates (pp.2, 3, and 4): LOST TIME CASES IN FEDERAL AGENCIES - 1980; LOST-TIME INJURY RATES--PRIVATE SECTOR--FEDERAL AGENCIES--NASA--SELECTED INDUSTRY; and INJURY RATES: PRIVATE--FEDERAL GOV'T--NASA--SELECTED INDUSTRY, and on page 5, a chart compares NASA rates since 1974. The LOST TIME CASES IN FEDERAL AGENCIES - 1980 shows a small decrease for several agencies and for All Government; however, there were several agencies showing increases. The rates shown on the charts for INDUSTRY were obtained from the Bureau of Labor Statistics and are one year late for our reports. The charts will be updated when the data becomes available. Although the NASA lost time injury rate increased steadily from 1969 until 1977, the total injury rate has decreased dramatically since 1973 (see p. 5).

The NASA lost time injury/illness frequency rate went down from 0.82 in 1977 to 0.81 in 1978, 0.69 in 1979, 0.67 in 1980, and 0.47 in 1981. In 1981, there were four NASA installations which were better than the agency rate of 0.47, JSC had a rate of 0.13, MSFC had 0.31, LaRC had 0.32, and KSC had 0.34. On page 6, one can see that the following installations reduced their lost time rates during 1981: ARC, GSFC, HQ, JSC, KSC, LaRC, and LeRC. ARC made the largest decrease in lost time frequency rate by reducing their rate from 1.50 to 0.88 (0.62 or 41%), and WFC followed with a reduction of 0.50 or 100%. JSC, KSC, and LaRC each reduced their rates more than 50%. Pages 7 thru 9 are comparisons of Lost Time Injuries/Illnesses vs Time, and pages 10 and 11 compare severity rates. The cost of accidents and injuries is graphically shown on pages 13 thru 16.

All centers submitted Form 345's (Accident Cause Analysis Reports, pp. 17 and 18) for Federal Employees. The lost time cases indicated here differ by only 4 percent from those reported on the Form 102F's (Federal Occupational Injuries and Illness Survey). The total cases are significantly greater than those listed on the 102F's. This may indicate that some centers include first aid cases while others do not. Seven centers also included 345's for contractors, pp. 19 and 20. Again there are some numbers that seem to be inconsistent; however, these apparent disagreements may be the result of how reportable cases and first aid cases are recorded.

As in years past, the message from all of this is that while slips, trips, and falls will always be with us, top managers can and should exercise more direct supervision of day-by-day working conditions, fully investigate each injury, and take action to prevent recurrences and potential abuse of Continuation of Pay and Federal Employee Compensation procedures. Every effort should be made to drive the lost time rate toward the lower limits with the intent of returning to a rate of approximately 0.2 to 0.3 over the next several years.

In addition to bringing our frequency rates in line for government employees, we will put forth considerable effort to bring our contractor employee's injury/illness frequency rates into line with those of our own employees. We believe it is in the interest of NASA to have safety conscious employees. It saves money, prevents injury and suffering, and reduces losses of equipment and facilities.

LOST TIME CASES IN FEDERAL AGENCIES — 1980
OCCUPATIONAL INJURY RATES FOR CIVILIAN PERSONNEL
PER 200,000 MAN-HOURS

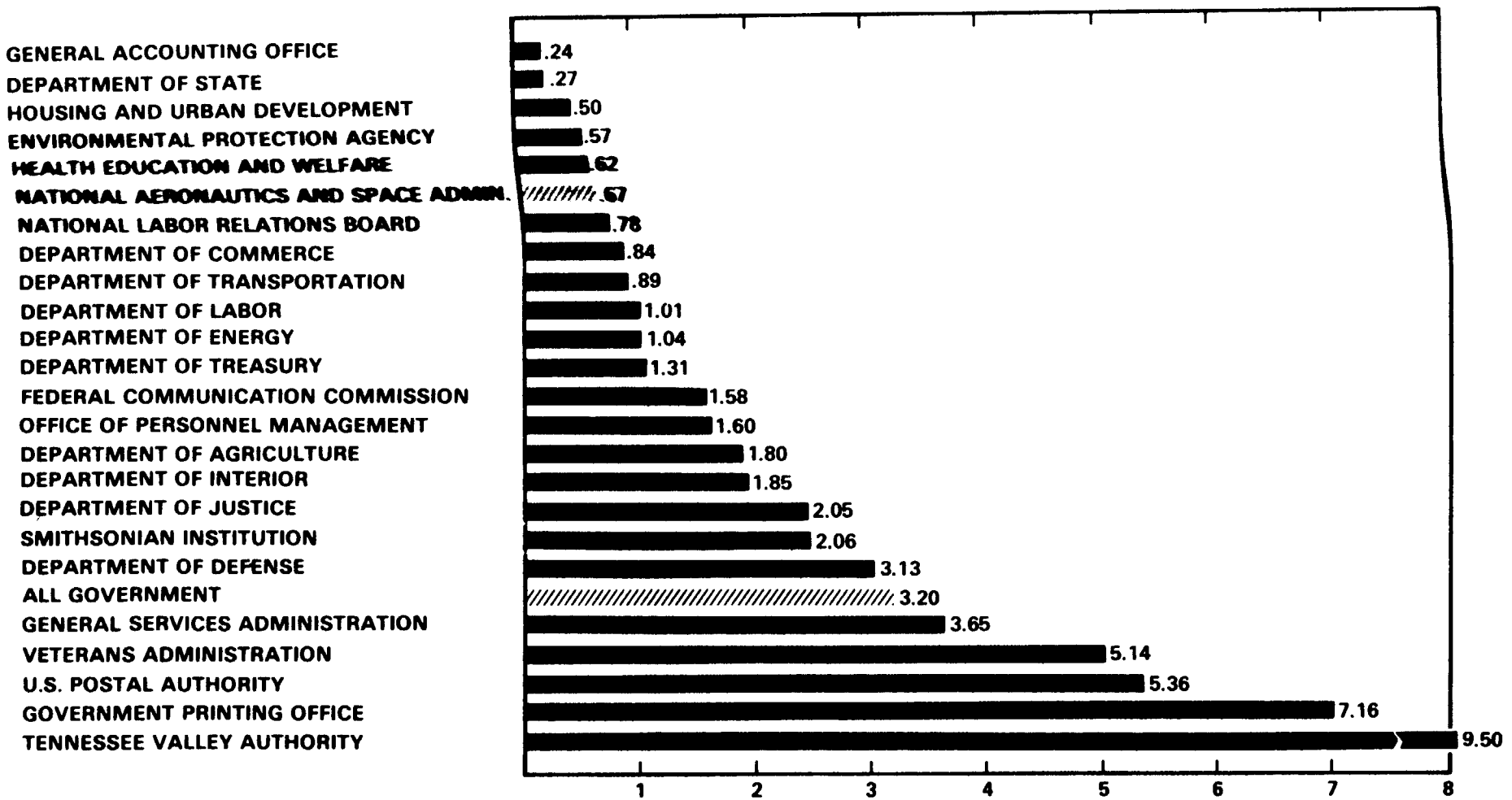


FIGURE 1

SOURCE: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, U.S. DEPARTMENT OF LABOR

NASA HQ NI80-4928 (1)
Rev. 7-21-81

LOST-TIME INJURY RATES: PRIVATE SECTOR-FEDERAL AGENCIES-NASA-SELECTED INDUSTRY

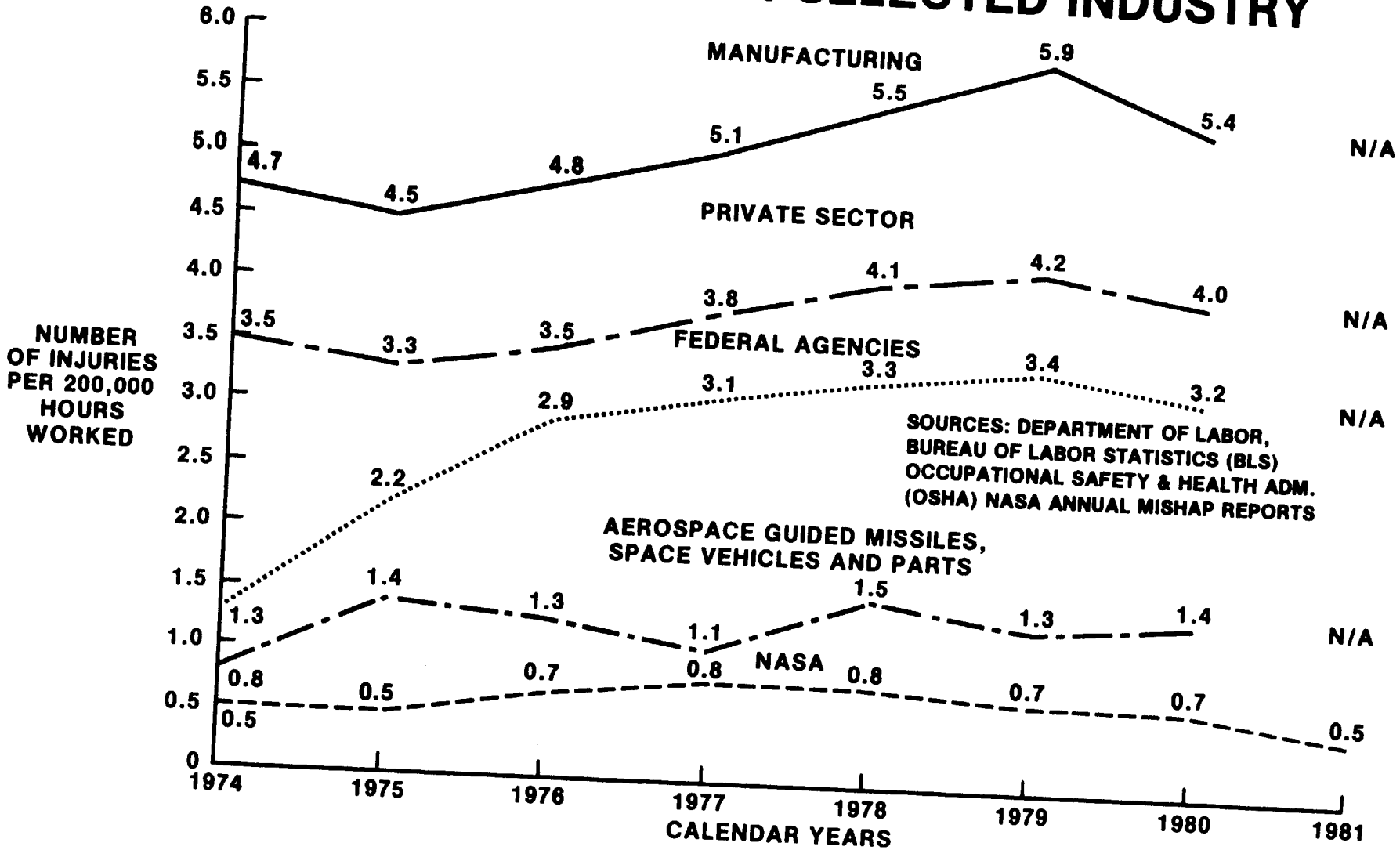
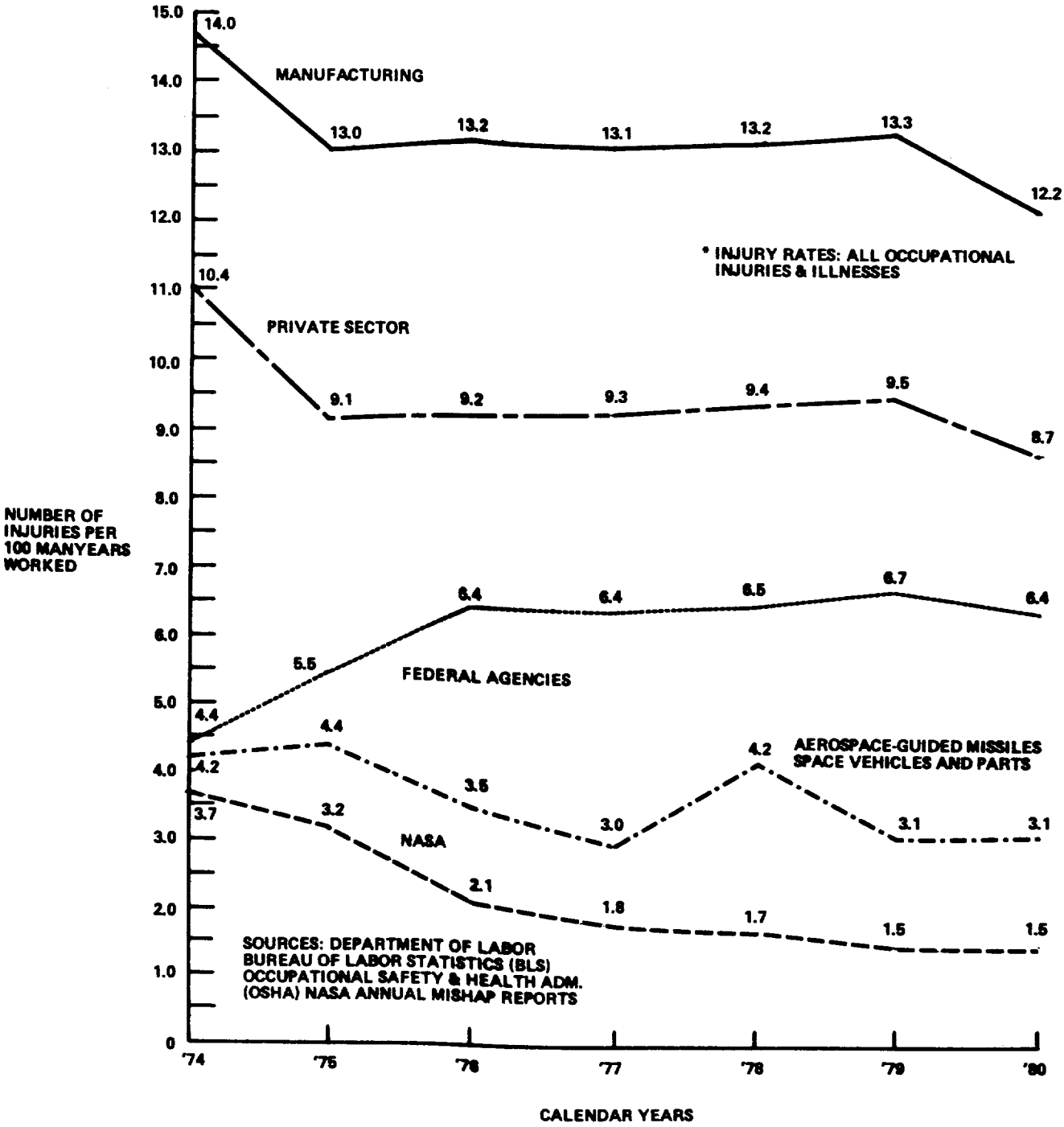


Figure 2
3

INJURY RATES:* PRIVATE SECTOR-FEDERAL AGENCIES-NASA-SELECTED INDUSTRY



NASA

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11-27-81

Figure 3

NASA OCCUPATIONAL INJURY/ILLNESS* RATES**
(1974-1981)

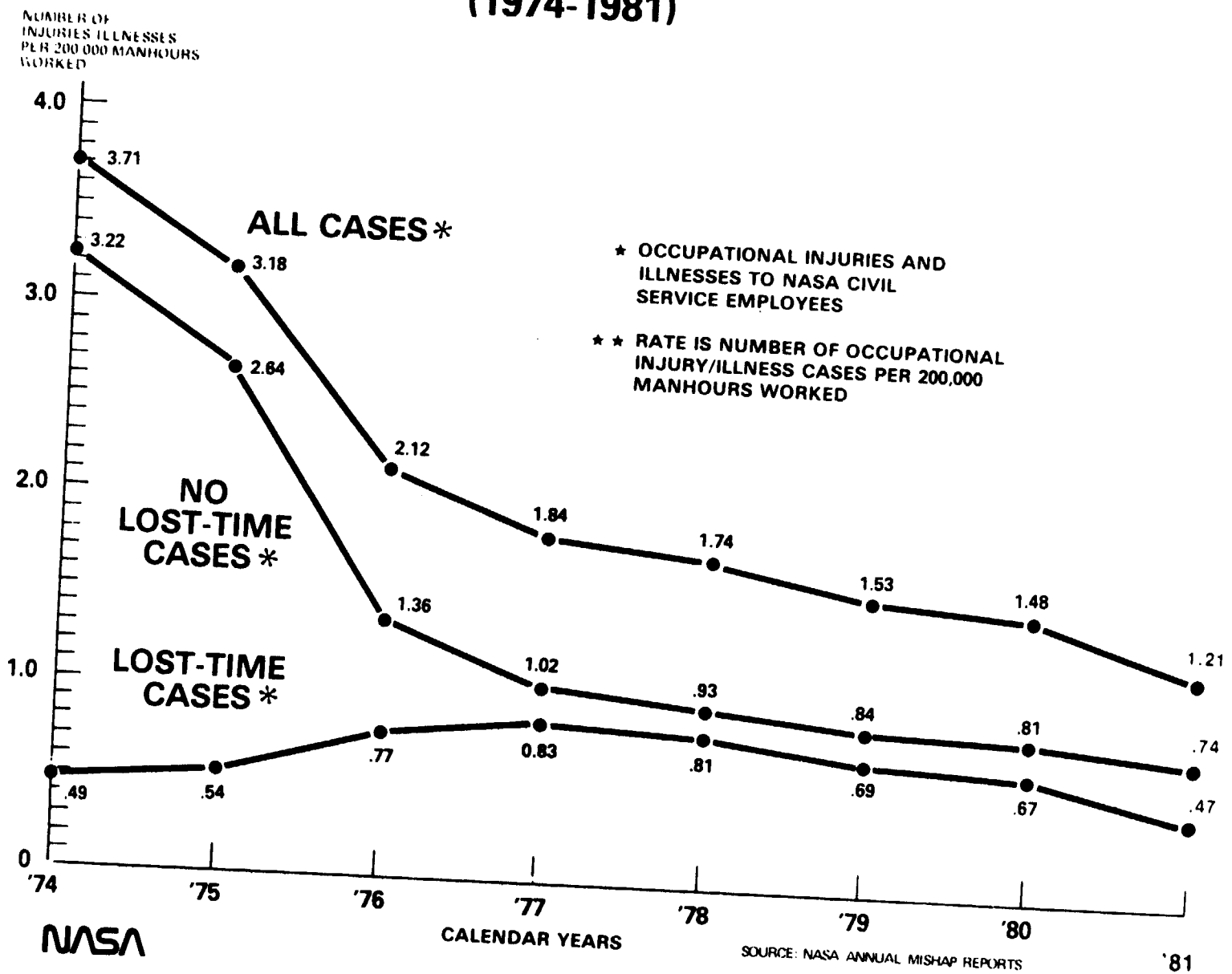


Figure 4
5

NASA INJURY AND ILLNESS DATA BY INSTALLATION - - ANNUAL 1981

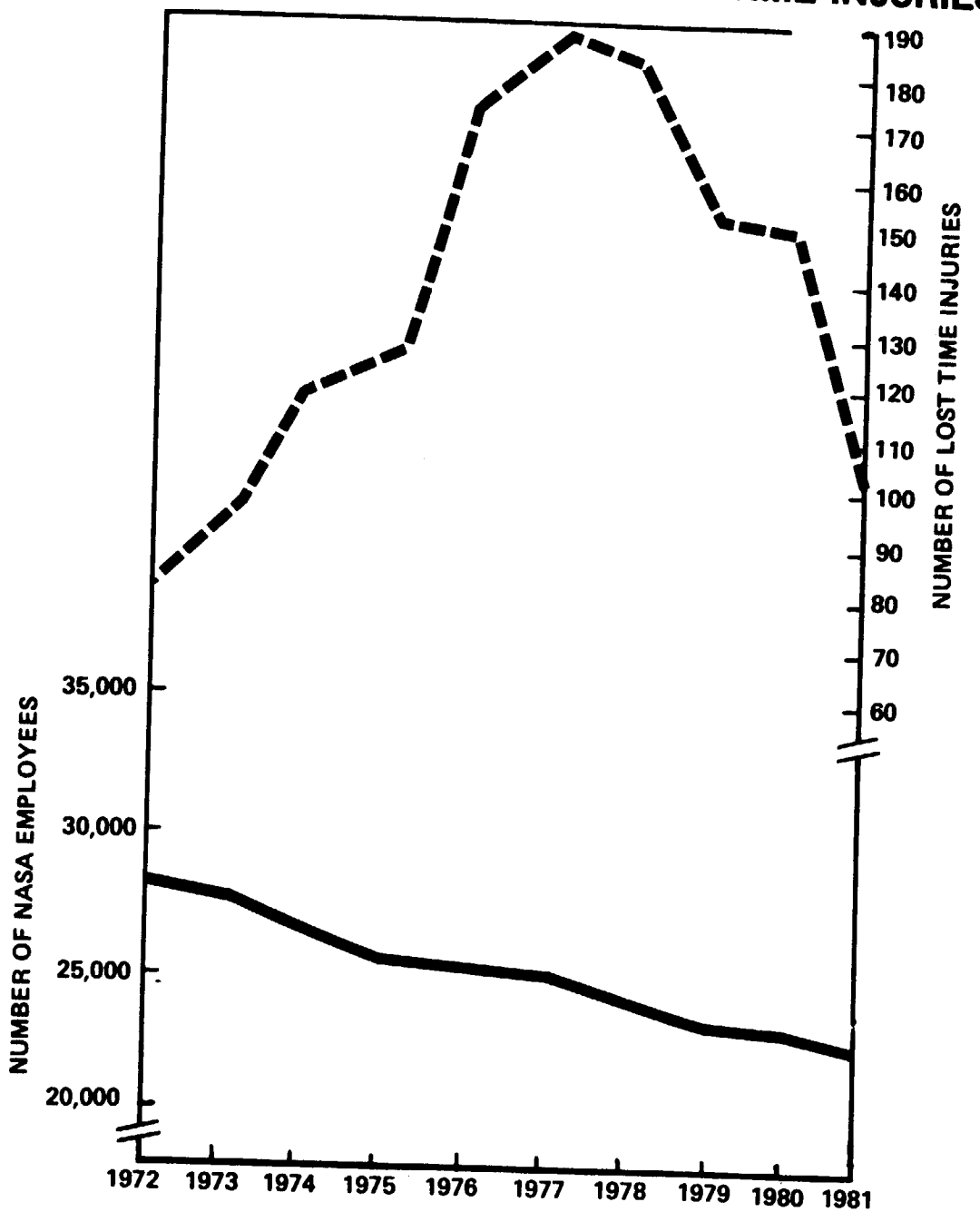
5/28/82

	NO. OF EMPLOYEES	HRS WORKED IN (K)	TOTAL INJURY/ ILLNESS DATA NO. CASES	FREQ. RATE 1980	FREQ. RATE 1981	LOST TIME INJURY/ILLNESS DATA NO. CASES	NO. DAYS	FREQ. RATE 1980	FREQ. RATE 1981	SEVERITY RATE	LOST TIME RATE OBJECTIVE FOR 1981 CUM RATE	LOST TIME RATE OBJECTIVE FOR 1981 TARGET RATE
ARC	1,705	3,173	21	2.02	1.32	14	202	1.50	0.88	12.73	0.88	1.20
DFRC	467	902	6	1.33	1.33	4	16	1.11	0.89	3.55	0.89	0.89
GSFC	3,596	6,479	34	1.21	1.05	22	454	0.76	0.68	14.01	0.68	0.68
HQ	1,695	3,087	27	2.80	1.75	9	158	0.60	0.58	10.24	0.58	0.54
JSC	3,682	7,507	38	0.35	1.01	5	49	0.30	0.13	1.31	0.13	0.30
KSC	2,280	4,752	11	0.79	0.46	8	186	0.70	0.34	7.83	0.34	0.56
LaRC	3,087	5,586	43	1.48	1.54	9	42	0.72	0.32	1.50	0.32	0.65
LeRC	2,874	5,117	57	3.88	2.23	19	193	1.19	0.74	7.54	0.74	0.95
MSFC	3,460	6,435	16	0.48	0.50	10	128	0.09	0.31	3.98	0.31	0.09
NSTL	114	244	3	0	2.46	3	25	0	2.46	20.51	2.46	0
WFC	400	726	11	3.49	3.03	0	0	0.50	0	0	0	0.45
TOTAL	23,360	44,008	267	1.48	1.21	103	1,453	0.67	0.47	6.60	0.47	
LAST YEAR	23,539	44,483	329	1.48	-.-	149	1,677	0.67	-.-	7.54		

1. TOTAL INJURY/ILLNESS FREQUENCY RATE = NO. OF CASES PER 200,000 HOURS WORKED.
2. LOST TIME INJURY/ILLNESS FREQUENCY RATE = NO. OF LOST WORKDAY CASES PER 200,000 HOURS WORKED.
3. INJURY/ILLNESS SEVERITY RATE = NO. OF LOST WORKDAYS PER 200,000 HOURS WORKED.

Figure 5

NUMBER OF NASA EMPLOYEES AND NUMBER OF LOST TIME INJURIES VS TIME



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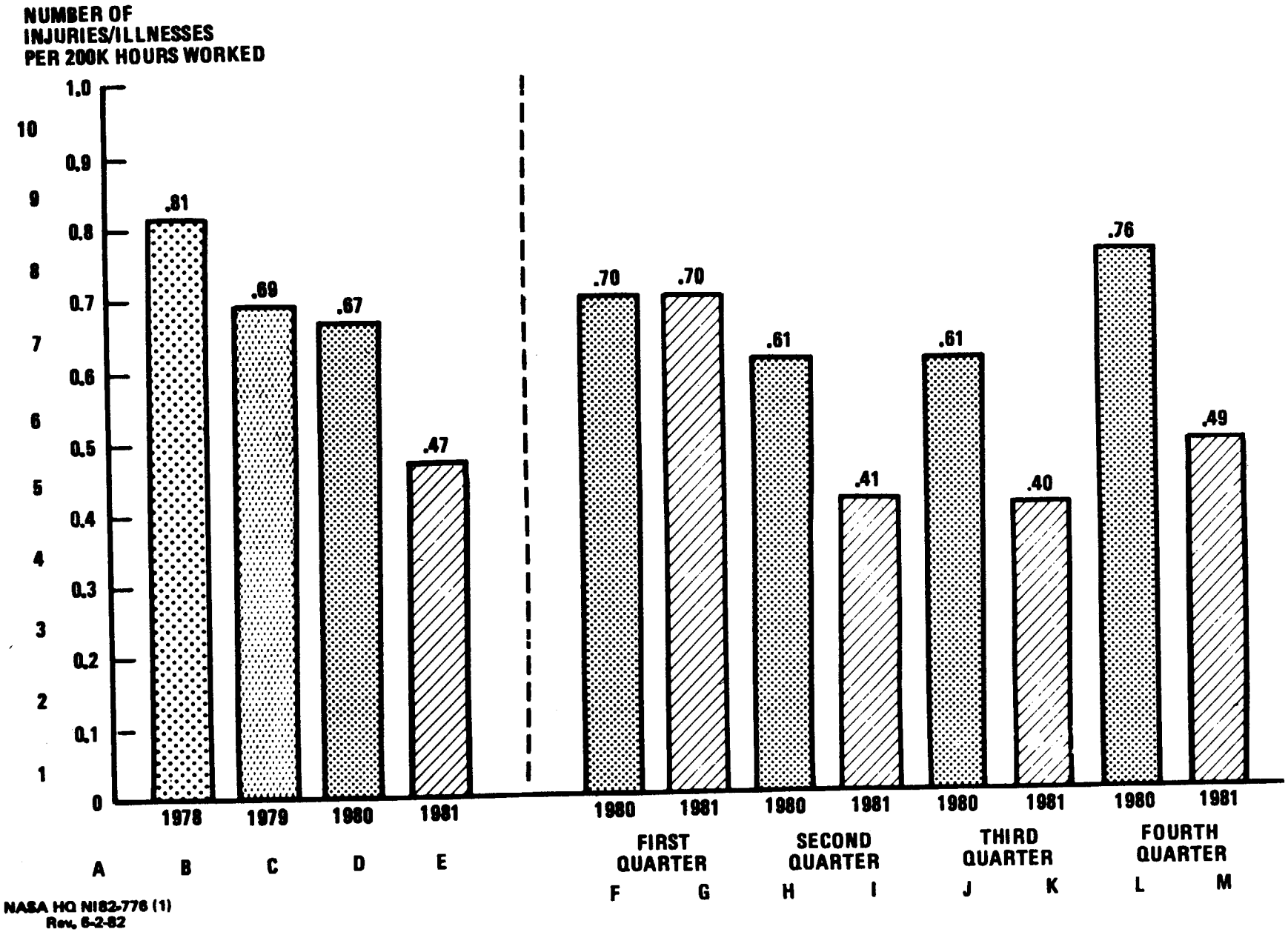
REV. 5-5-82

Figure 6

NASA LOST TIME INJURY/ILLNESS RATES - YEARLY AND QUARTERLY COMPARISON



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Rev. 6-2-82

Figure 7
8

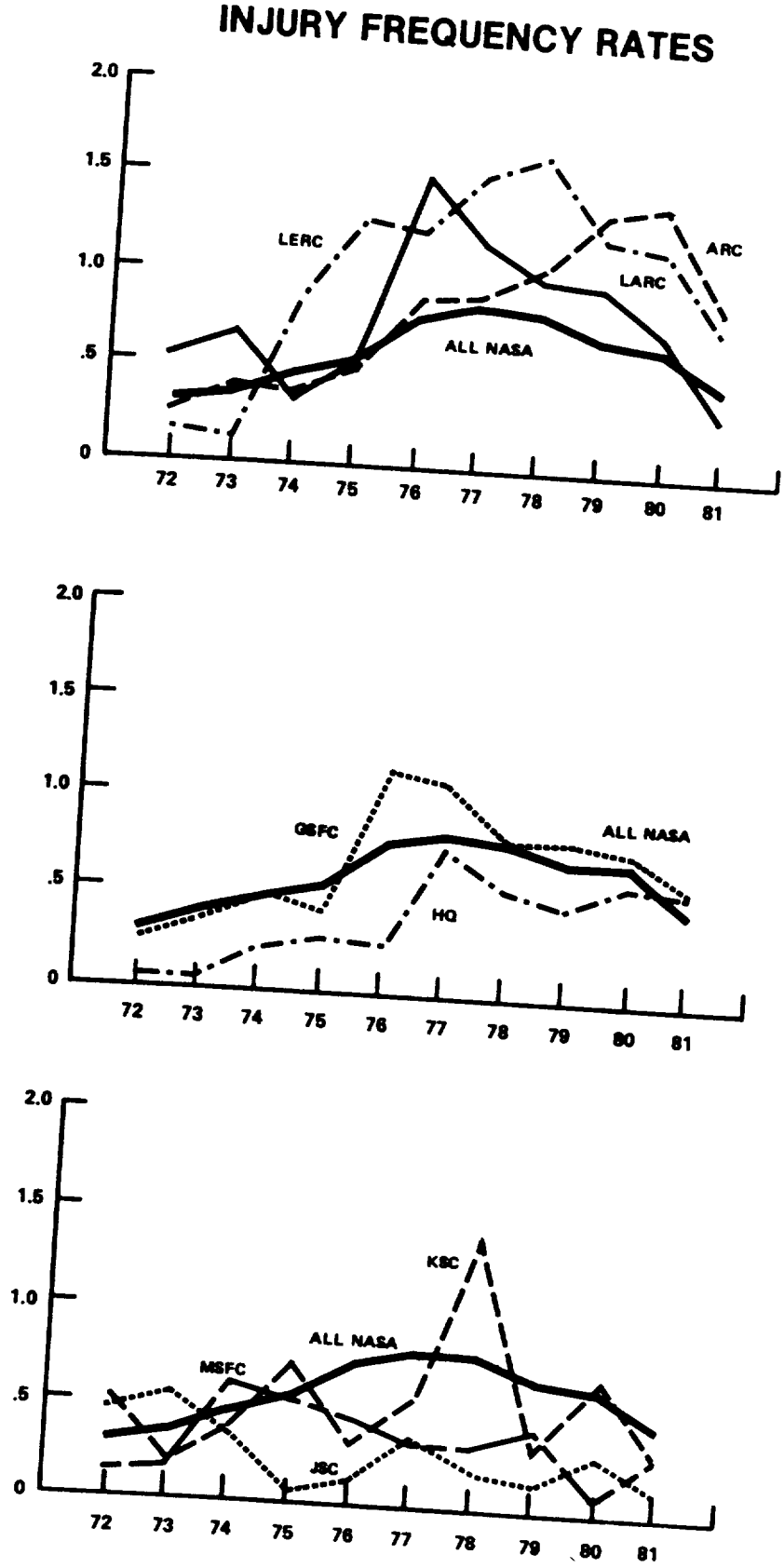

INJURY FREQUENCY RATES
2.0
1.5
1.0
.5
0
LERC
ARC
LARC
ALL NASA
72
73
74
75
76
77
78
79
80
81
GSFC
HQ
KSC
MSFC
JSC

Figure 8

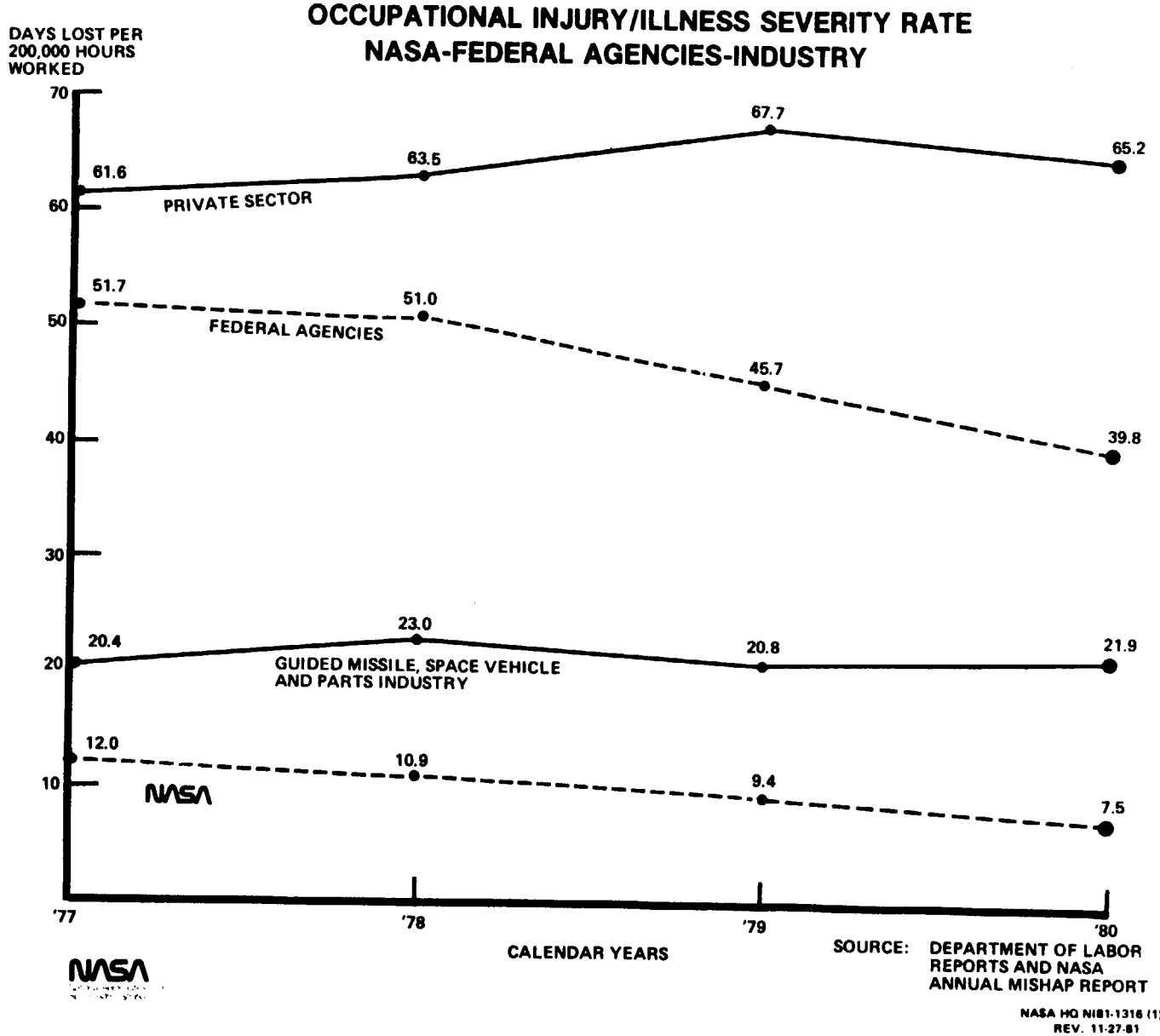
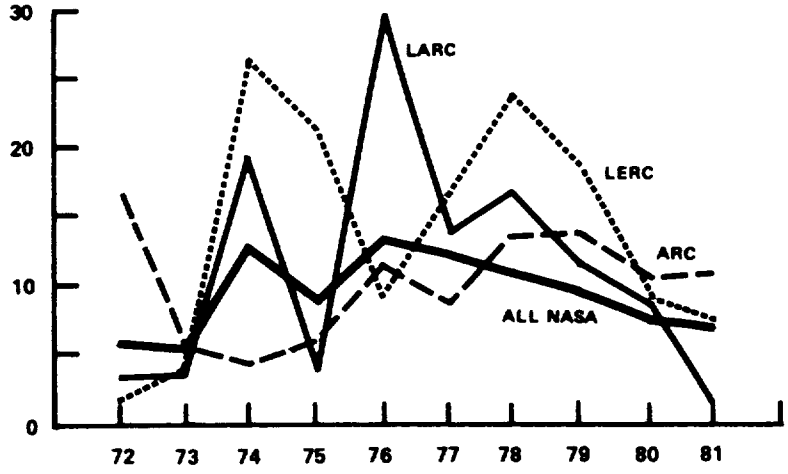
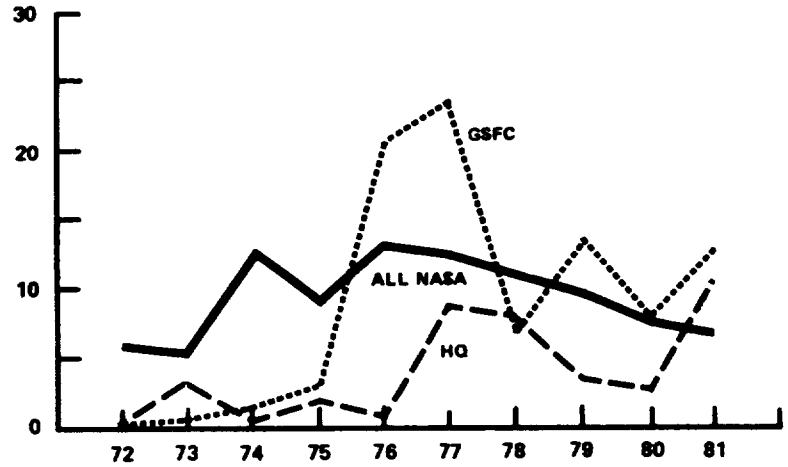

OCCUPATIONAL INJURY/ILLNESS SEVERITY RATE
NASA-FEDERAL AGENCIES-INDUSTRY
DAYS LOST PER 200,000 HOURS WORKED
70
60
50
40
30
20
10
61.6
63.5
67.7
65.2
PRIVATE SECTOR
51.7
51.0
45.7
39.8
FEDERAL AGENCIES
20.4
23.0
20.8
21.9
GUIDED MISSILE, SPACE VEHICLE AND PARTS INDUSTRY
12.0
10.9
9.4
7.5
NASA
'77
'78
'79
'80
CALENDAR YEARS
SOURCE: DEPARTMENT OF LABOR REPORTS AND NASA ANNUAL MISHAP REPORT
NASA HQ NI81-1316 (1)
REV. 11-27-81

Figure 9
10

INJURY SEVERITY RATES





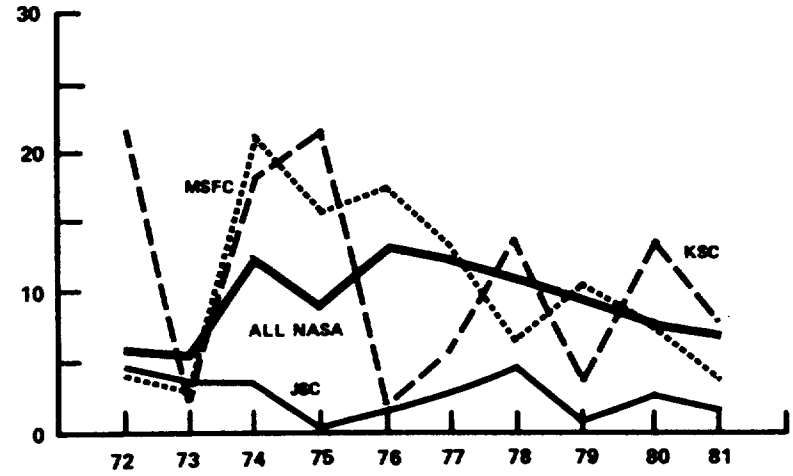


Figure 10

NASA MISHAP DATA BY INSTALLATION - - ANNUAL 1981

	AUTO MISHAP FREQ. RATE		AIRCRAFT MISHAPS		FIRE LOSSES		OTHER MISHAPS		TOTAL MISHAPS	
	GOV	POV	NO.	RATE	NO.	($K)	NO.	($K)	COST ($K)	RATE ($K)
ARC	0	0	2	62.07	4	6.40	3	193.00	397.91	125.41
DFRC	0	0	0	0	0	0	0	0	0	0
GSFC	2.08	0.81	0	0	0	0	1	25.03	27.01	4.17
HQ	16.65	1.82	0	0	0	0	0	0	0.95	0.31
JSC	0	0	0	0	0	0	0	0	0	0
KSC	3.47	2.61	0	0	6	158.44	6	27.63	188.02	39.57
LaRC	1.63	0	0	0	3	136.10	4	110.00	246.62	44.15
LeRC	1.37	0	0	0	3	87.78	0	0	88.28	17.25
MSFC	6.27	0	0	0	0	0	0	0	7.09	1.10
NSTL	0	0	0	0	0	0	0	0	0	0
WFC	4.01	0	0	0	0	0	0	0	3.50	4.82
TOTALS	3.94	2.24	2	7.73	16	388.72	14	355.66	959.37	21.80

1. AIRCRAFT MISHAP FREQ. RATE = NO. OF MISHAPS PER 100,000 HOURS FLOWN.
2. MOTOR VEHICLE MISHAP FREQ. RATE = NO. OF MISHAPS PER MILLION MILES DRIVEN.
3. TOTAL COST OF MISHAPS INCLUDES REPAIRS/REPLACEMENTS OF MOTOR VEHICLES AND DAMAGE, AND TORT CLAIMS (AS ON OSHA FORM 102FF).
4. MISHAP COST RATE = TOTAL COST OF MISHAPS PER MILLION HOURS WORKED.

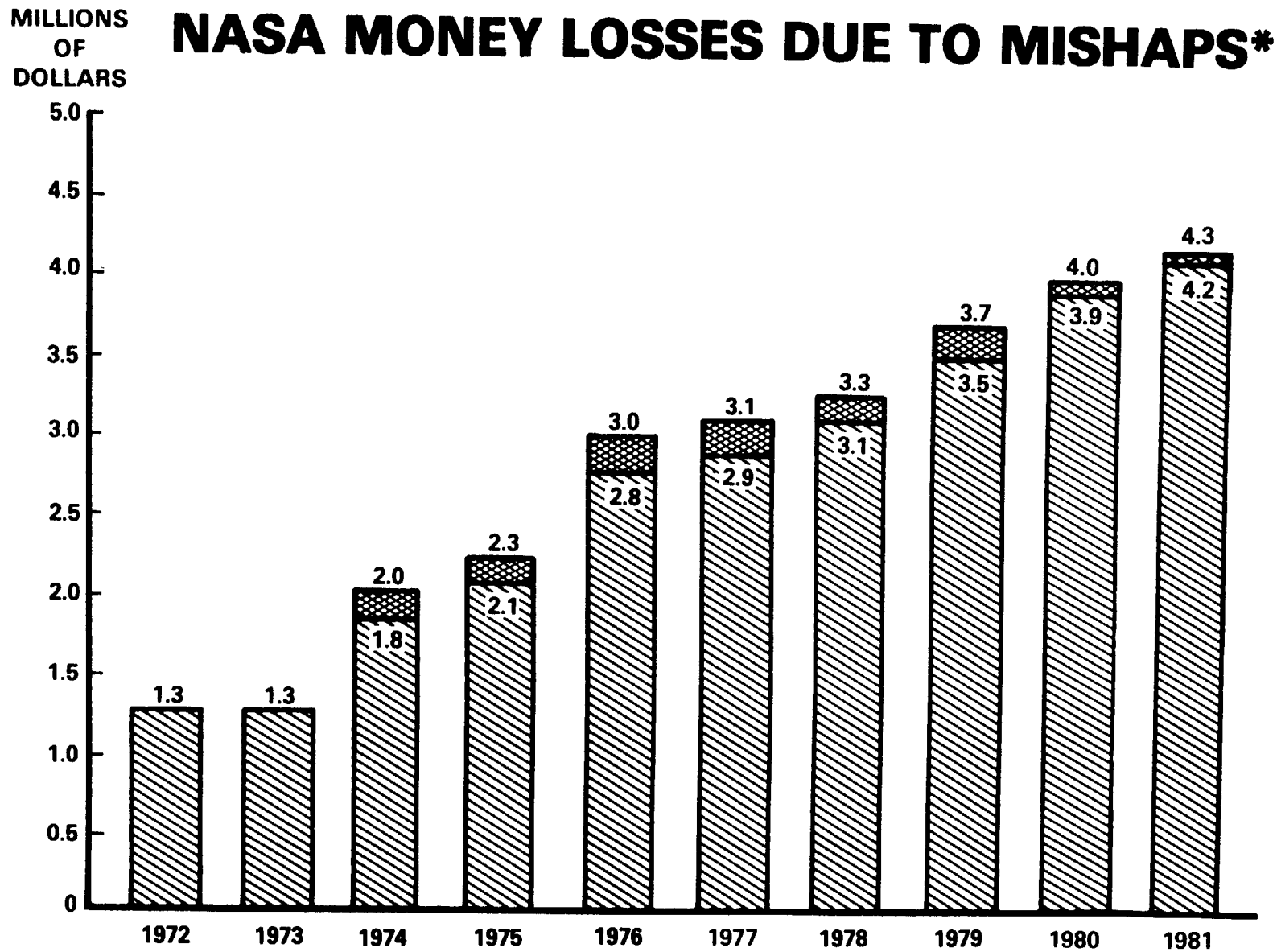
COST OF CY 1981 NASA ACCIDENTS/INCIDENTS/INJURIES

MANPOWER LOSS			4	FATALITIES
			165	NON-LOST WORKDAY INJURIES
			103	LOST WORKDAY INJURIES
			1453	WORK DAYS LOST = 5.59 YEARS EFFORT
MONEY LOSS	WAGES	$	127,575	
	(COP RELATED COSTS) CHARGE BACK BILLING TO FEDERAL EMPLOYEES COMPENSATION FUND (1981)	$	4,173,392	
	SUB-TOTAL	$	4,300,967	
				NO. OF MISHAPS
MATERIAL LOSS	AIRCRAFT	$	195,000	2
	VEHICLES		10,982	47
	FIRE		800,000	20
	OTHER PROPERTY		355,660	14
	SUB-TOTAL	$	1,361,642	83
TOTAL LOSS		$	5,662,609	

DOES NOT INCLUDE CONTRACTOR DATA
DOES NOT INCLUDE FUTURE COSTS FOR THE INJURIES AND ILLNESSES;
SINCE THEY WILL BE PART OF THE ANNUAL CHARGEBACK BILLING
DOES NOT INCLUDE MISSION FAILURES
DOES NOT INCLUDE TEST OPERATIONS FAILURES

Figure 12
13

NASA MONEY LOSSES DUE TO MISHAPS*



*INCLUDES LOST WAGES AND CHARGE BACK BILLING TO THE FEDERAL EMPLOYEES COMPENSATION FUND, BUT DOES NOT INCLUDE CONTRACTOR LOSSES.

LOST WAGES

CHARGE BACK BILLING

NASA HQ NI80-4398(1)
REV. 5-5-82

Figure 13
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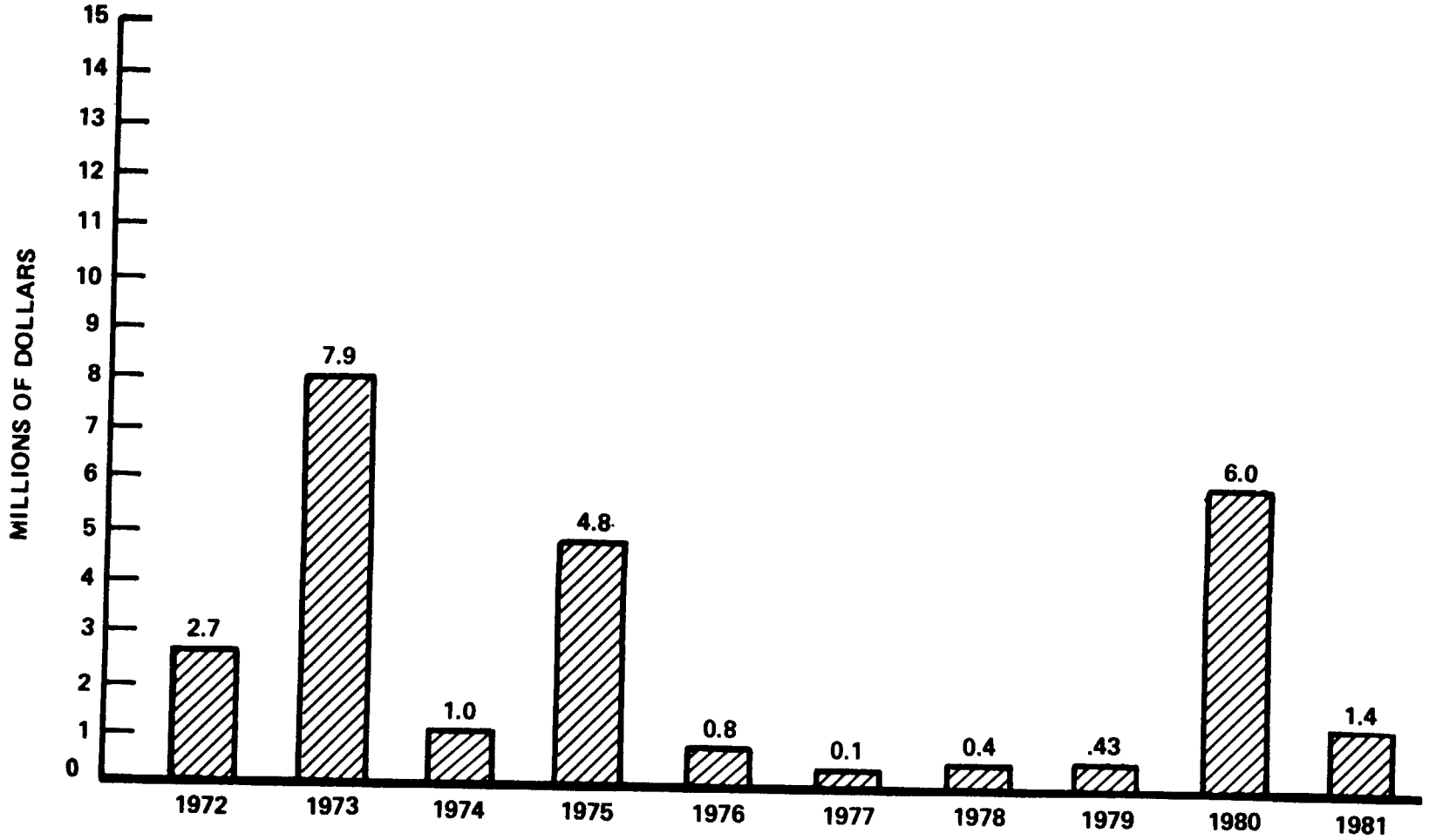
NASA MATERIAL LOSSES DUE TO MISHAPS*

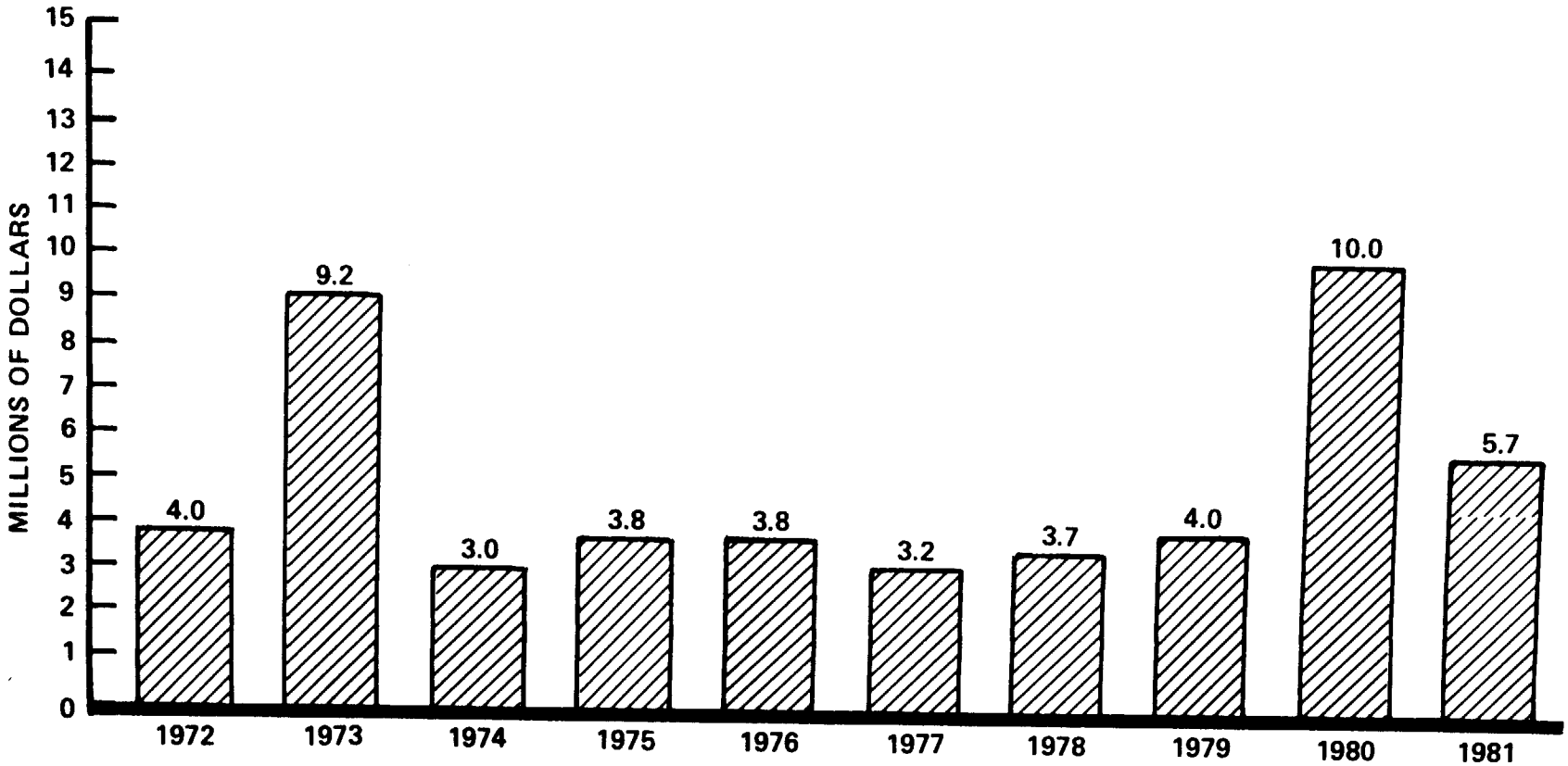


* INCLUDES AIRCRAFT, VEHICLE, AND FIRE MISHAPS AND LOSSES OF OTHER PROPERTY.
DOES NOT INCLUDE CONTRACTOR LOSSES.
DOES NOT INCLUDE MISSION FAILURES.
DOES NOT INCLUDE TEST OPERATIONS LOSSES.

NASA HQ NI80-4392 (1)
REV. 5-5-82

Figure 14
15

TOTAL COSTS TO NASA DUE TO MISHAPS*



* DOES NOT INCLUDE CONTRACTOR LOSSES.
* DOES NOT INCLUDE MISSION FAILURES.
* DOES NOT INCLUDE TEST OPERATIONS LOSSES.

Figure 15
16

NASA HQ NI80-4393 (1)
REV. 5-5-82

ACCIDENT CAUSE ANALYSIS REPORT

CIVIL SERVANTS

Report No./Year (Calendar) 1981

INSTALLATION	MONTHLY TOTALS			QUARTER TOTAL	TOTAL TO DATE	
SECTION I: SHIFT						
a.					25	83
b.					1	7
c.					1	1
SECTION II: PART OF BODY INJURED						
a. Head					5	40
b. Eye					9	48
c. Face					4	15
d. Arm					7	48
e. Hand					5	67
f. Finger					5	89
g. Torso					8	33
h. Back					31	58
i. Chest					2	4
j. Abdomen					5	8
k. Leg					15	73
l. Foot					6	34
m. Toe					2	11
n. Other					4	28
SECTION III: AGENCY INVOLVED						
a. Animals						10
b. Boilers and Pressure Vessels						
c. Chemicals					1	28
d. Conveyors						
e. Dusts					1	10
f. Electrical Apparatus					1	7
g. Elevators					1	2
h. Hand Tools					6	34
i. Highly Flammable and Hot Substances					1	3
j. Hoisting Apparatus					2	14
k. Machines					6	50
l. Material Handling					20	77
m. Mechanical Power Transmission Apparatus						
n. Prime Movers and Pumps						
o. Radiation and Radiating Substances						2
p. Vehicles					3	23
q. Walking Surfaces					34	119
r. Agencies not elsewhere classified					23	168
SECTION IV: TYPE OF ACCIDENT						
a. Striking Against					16	103
b. Struck By					12	82
c. Caguht in, on, or between					4	34
d. Fall on same level					20	63
e. Fall to different level					10	21
f. Slip (not fall) or over-exertion					25	62
g. Exposure to temperature extremes					1	7
h. Contact with electric current						2
i. Inhalation, absorption, swallowing						8
j. Electric welding flash					1	4
k. Foreign body in eye					5	33
l. Type of accident not elsewhere classified					14	107

NASA FORM 345 (REV. APRIL 66) Previous Editions Are Obsolete.

Figure 16

INSTALLATION	MONTHLY TOTALS			QUARTER TOTAL	TOTAL TO DATE	
SECTION V: UNSAFE MECHANICAL CONDITION						
a. Improper Guarding					1	16
b. Defective Substances or Equipment					9	33
c. Hazardous Arrangement					11	38
d. Improper Illumination						2
e. Improper Ventilation						2
f. Unsafe Clothing					1	3
g. No unsafe condition					64	305
h. Unsafe condition not elsewhere classified					13	78
SECTION VI: UNSAFE ACT						
a. Operating without authority					1	5
b. Operating or working at unsafe speed					2	33
c. Making safety devices inoperative						
d. Using unsafe equip/hands instead of equip/equip unsafely					5	36
e. Unsafe loading, placing, mixing, etc.					6	24
f. Taking unsafe position or posture					23	103
g. Working or moving on dangerous equipment					1	4
h. Distraction, teasing, abusing, startling, etc.					3	15
i. Failure to use safe attire or pers. protective devices					5	37
j. No unsafe act					40	197
k. Unsafe act not elsewhere classified					13	83
SECTION VII: TYPE OF INJURY						
a. Abrasion					2	24
b. Avulsion					2	4
c. Burn, Chemical/Cryogenic					1	9
d. Burn, Thermal					1	14
e. Contusion					19	112
f. Dermatosis						5
g. Foreign Body					3	42
h. Fracture					11	27
i. Laceration					7	96
j. Puncture					1	25
k. Sprain or Strain					47	136
l. Toxicological					3	12
SECTION VIII: NO. LOST TIME INJURIES					7	42
Total					99	450

SECTION IX: REMARKS

Legend

25	Denotes injury cases only.
5/25	Top number denotes lost-time injury cases. Bottom number denotes injury cases.

PREPARED BY: Thomas B. Kerr

SUBMITTED BY

GPO 906-670

ACCIDENT CAUSE ANALYSIS REPORT

CONTRACTORS

Report No./Year (Calendar) 1981

INSTALLATION	MONTHLY TOTALS			QUARTER TOTAL	TOTAL TO DATE	
SECTION I: SHIFT						
a.					14	22
b.					3	3
c.					1	1
SECTION II: PART OF BODY INJURED						
a. Head					20	107
b. Eye					7	235
c. Face					9	44
d. Arm					11	178
e. Hand					12	217
f. Finger					14	453
g. Torso					15	72
h. Back					69	190
i. Chest					3	15
j. Abdomen					2	17
k. Leg					40	215
l. Foot					10	123
m. Toe					3	26
n. Other					12	83
SECTION III: AGENCY INVOLVED						
a. Animals					1	19
b. Boilers and Pressure Vessels					3	7
c. Chemicals					5	144
d. Conveyors					0	1
e. Dusts					4	93
f. Electrical Apparatus					5	55
g. Elevators					2	8
h. Hand Tools					5	256
i. Highly Flammable and Hot Substances					1	11
j. Hoisting Apparatus					10	23
k. Machines					12	130
l. Material Handling					57	364
m. Mechanical Power Transmission Apparatus					1	6
n. Prime Movers and Pumps					0	3
o. Radiation and Radiating Substances					0	0
p. Vehicles					14	80
q. Walking Surfaces					41	250
r. Agencies not elsewhere classified					66	518
SECTION IV: TYPE OF ACCIDENT						
a. Striking Against					17	434
b. Struck By					34	377
c. Caguht in, on, or between					16	152
d. Fall on same level					25	124
e. Fall to different level					16	41
f. Slip (not fall) or over-exertion					63	265
g. Exposure to temperature extremes					4	29
h. Contact with electric current					1	9
i. Inhalation, absorption, swallowing					5	67
j. Electric welding flash					0	7
k. Foreign body in eye					6	179
l. Type of accident not elsewhere classified					38	290

NASA FORM 345 (REV. APRIL 66) Previous Editions Are Obsolete.

Figure 17

INSTALLATION	MONTHLY TOTALS			QUARTER TOTAL	TOTAL TO DATE	
SECTION V: UNSAFE MECHANICAL CONDITION						
a. Improper Guarding					3	64
b. Defective Substances or Equipment					10	56
c. Hazardous Arrangement					23	157
d. Improper Illumination					0	5
e. Improper Ventilation					3	9
f. Unsafe Clothing					1	38
g. No unsafe condition					108	1,249
h. Unsafe condition not elsewhere classified					43	288
SECTION VI: UNSAFE ACT						
a. Operating without authority					0	0
b. Operating or working at unsafe speed					1	13
c. Making safety devices inoperative					3	8
d. Using unsafe equip/hands instead of equip/equip unsafely					4	169
e. Unsafe loading, placing, mixing, etc.					15	120
f. Taking unsafe position or posture					75	394
g. Working or moving on dangerous equipment					6	19
h. Distraction, teasing, abusing, startling, etc.					5	19
i. Failure to use safe attire or pers. protective devices					8	167
j. No unsafe act					54	630
k. Unsafe act not elsewhere classified					18	317
SECTION VII: TYPE OF INJURY						
a. Abrasion					4	124
b. Avulsion					2	27
c. Burn, Chemical/Cryogenic					1	56
d. Burn, Thermal					2	50
e. Contusion					29	340
f. Dermatosis					0	19
g. Foreign Body					5	198
h. Fracture					15	37
i. Laceration					13	390
j. Puncture					2	71
k. Sprain or Strain					103	448
l. Toxicological					9	72
SECTION VIII: NO. LOST TIME INJURIES					6	35
Total					218	1,641

SECTION IX: REMARKS

Legend

25	Denotes injury cases only.
5/25	Top number denotes lost-time injury cases. Bottom number denotes injury cases.

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SUBMITTED BY

GPO 906-670

NASA RELATED ACCIDENTS AND FATALITIES IN 1981

DEFINITIONS:

1. NASA Mishap - Any occurrence, event, or anomaly that may be classed as a NASA accident, incident, or mission failure.
2. Type A Accident - A mishap causing death, disabling injury to five or more person, damage to equipment or property exceeding $100,000*, or destruction of an aircraft.
3. Type B Accident - A mishap causing disabling injury to four or fewer persons or damage to equipment or property exceeding $10,000*, but less than $100,000*.
4. Incident - A mishap of less than accident severity to persons or property, causing less than $10,000* in damages, but exceeding $100, or a non-serious injury.
5. Mission Failure - Any event which jeopardized a mission, prevents accomplishment of major mission objectives, or causes premature mission termination (not included in this report).
6. Costs - Direct costs of repair, replacement, or recovery; including man-hours, material, and contract costs, but excluding indirect costs of clean-up, investigation, injury, and normal operational delay.

* The cost used in these definitions were changed in early 1982 and will be used in future reports.

SIGNIFICANT MISHAPS

The significant mishaps shown on the following charts are those reported by the NASA Field Installations and contractors as having significance beyond the minor dollar losses or injury incident categories.

FATAL ACCIDENTS AND FATALITIES

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
NUMBER OF FATAL ACCIDENTS	3	2	2	3	1	6	1	1	0	7
TOTAL NUMBER OF FATALITIES	4	17	3	3	1	6	1	1	0	9
NASA EMPLOYEES	2	7	0	0	0	2	0	1	0	4
CONTRACTOR EMPLOYEES	2	4	1	1	1	3	1	0	0	5
PUBLIC	0	1	2	2	0	1	0	0	0	0
MILITARY	0	5	0	0	0	0	0	0	0	0

TYPE A/B ACCIDENTS BY FIELD INSTALLATIONS

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AMES	0/0	1/0	0/2	1/0	1/1	0/0	1/3	0/6	0/0	2/3
GODDARD	0/1	0/0	1/2	0/2	0/2	1/4	0/0	0/1	1/1	0/3
HDQTRS	-	-	-	2/1	0/0	0/1	0/0	0/0	0/0	0/0
JOHNSON	6/2	1/0	0/5	0/1	0/0	2/1	0/0	0/2	1/0	2/0
KENNEDY	1/0	0/1	2/1	4/1	0/0	2/1	0/0	0/0	0/1	5/3
LANGLEY	0/1	0/1	0/1	0/2	1/1	0/0	0/1	0/0	0/0	3/4
LEWIS	2/0	0/1	0/0	0/1	0/1	0/0	0/0	1/1	0/0	0/2
MARSHALL	6/2	1/0	1/0	1/1	0/0	1/0	0/0	0/0	2/1	1/0
NSTL	-	-	0/0	0/1	0/1	1/0	0/0	0/0	0/0	1/1
NASA TOTAL	15/6	4/6	7/11	10/12	2/9	8/7	1/4	1/10	4/3	14/16

Notes: The Type "B" individual injuries are not listed in this table, but the number of injuries are shown in the summary in Figure 5, p.6.

Test Operations accidents and Mission failures are not included in this report. These are associated with program activities and are reviewed by program offices. This does not reduce any safety responsibilities for NASA operations. However, it recognizes that these mishaps occur at facilities where the nature of the test operations involve predictably high risks/hazards, and the operations personnel are responsible for safety.

The combination of Type "A" and "B" accidents in 1981 was 30 as compared to 7 in 1980, and the number of Type "A" accidents was 14 compared to 4 in 1980. There does not appear to be an obvious lack of supervision, but the fact that some of these accidents occurred at all indicates a need for tightening up operational procedures. This should include design reviews of test items, test apparatus, and procedures and compatibility of the associated support equipment.

TYPE "A" ACCIDENTS - 1981

LOCATION	DATE	DESCRIPTION	CAUSE	COST	RECOMMENDED CORRECTIVE ACTION
LaRC	01-05-81	-Installing 8,450 pound model support apparatus, strut shifted position and exerted force which tipped A-frame over.	-Lift was performed without lateral restraint.	Fatality	-Install permanent overhead gantry for this model support apparatus. -Increase base-width of this A-frame to 6-feet. -Analyze feasibility of lifting strut from attachment points about center of gravity. -Lateral restraints for all lifts with offset center of gravity. -Establish procedures to ensure safe rigging practices are adhered to. -Survey all existing A-frames and modify to meet safe configuration guidelines.
KSC	01-11-81	-Delta Launch Vehicle 154 being readied for launch of GOES-E from LC-17A at CCAFS. Vehicle damaged by Mobile Service Tower.	-Breakdown in Test Team discipline, dificiencies in procedure in use.	$100K	-Management emphasis on daily operations, procedure improvement, reinforce adherence to policy directives, operational discipline, task leader selection.
KSC	03-19-81	-At LC-39A, Rockwell employees reported to work at Orbiter aft compartment. Two employees entered GN_2 environment, lost consciousness. Third employee tried to call for help, lost consciousness while attempting rescue. Two others lost consciousness during rescue attempt.	-Inadequate procedures, breakdown in operational command/coordination process.	Two Fatalities, three injuries.	-Procedure improvement in following areas: erroneous information and coordination break down, access control and hazard signs, test deviations control, parallel normal and hazardous operations, schedule conflicts, lack of sensory warning & immediate incapacitation, emergency procedures, drills, and training.
MAF	04-08-81	-Mooring Wharf "A" was struck by USNS "HARKNESS" and fell into the water.	-Mooring line change caused the HARKNESS to strike the wharf with enough energy to collapse the pile foundations.	$325K	-Mooring plans must be developed and engineering assessment obtained from MAF Facility Office prior to docking large vessels at MAF.

ARC	04-16-81	-Workman crushed when rebar network collapsed on him at the new Static Test Facility.	-Rebar network not tied down securely.	Fatality	-Several recommendations by Investigation Board including: Better emergency communications instruction. Hire a Construction Safety Specialist. Train employees and contractors concerning safety requirements.
KSC	05-05-81	-At LC-39B, a Wilhoit employee was installing handrails on the 160' crossover between Fixed Service Structure and Rotating Service Structure. Grating he was standing on slipped from under him, and he fell 100' to the pad surface.	-Grating was not secured. -Adequate safety equipment not used.	Fatality	-Strengthen management and employee participation in contractor safety program. -Use safety lines and belts with lanyards tied off before starting work. -Daily monitoring and correction of unsatisfactory conditions and unsafe practices.
LaRC	06-03-81	-Smoke in electronics lab. discovered by security guard. Fire Department notified and fire extinquished.	-Power strip subjected to moisture accumulation from leaking roof most likely fire source. -Excessive fire loading, paper build-up, was noted in this area.	$117.6K	-All power strips of this type to be vertically mounted and when possible above the working surface. -De-energize power and lighting circuits in their area by turning off circuit breaker at end of day. -Excessive paper accumulation removed from laboratories. -Smoke detectors installed in return air ducts are on LaRC computerized maintenance program.
ARC	09-11-81	-Helicopter struck power line and crashed. One fatality and one serious injury.	-Struck power line during reduced visibility.	Fatality and $105K property damage.	-Requirements for VFR flights have been tightened.

KSC	09-22-81	-At LC-39A, on STS-2, a ground-half Quick Disconnect (QD) failed during servicing of oxidizer on Forward Reaction Control System (FRCS). -Significant quantity of oxidizer flowed directly on the Orbiter tiles, damage to 370 tiles which had to be removed.	-Failure of Quick Disconnect attributed to accumulation of iron nitrate lodged under probe. Dynamic head will tolerate no foreign matter. -Excessive amount of time required to stop leak.	$250K	-Should not use QD's as flow shutoff valves. -Emergency procedures inadequate. -Entry paths open to interior of vehicle - these had to be closed. -Excessive amount of time required to stop leak. -Inadequate emergency preparedness by test team. -Lack of familiarization by console personnel of total systems configuration. -Scuppers were not designed to contain massive leak. -Other fluids should be examined to identify and correct similar dificiencies.
Palmdale	10-03-81	-Right hand reinforced carbon carbon (RCC) leading edge panel fell from workbench in building 294.	-Panel fell off workbench while employee was placing protective cover on panel.	$125 K	-A holding fixture was built to support panel for operation.
JSC	10-10-81	-Electrical short in Building 221 caused fire.	-Unknown.	$130K	-Corrective measures are being implemented as a result of the investigation.
NSTL	10-13-81	-Pan Am contract fireman entered Bldg. 8100 on routine fire alarm inspection. -Concrete tie beam cut loose by another contractor was propelled across room, struck fireman—crushed him.	-Improper guarding of area during hazardous operations. -Inadequate training and supervision of contractor personnel.	Fatality	-Require monitoring of contractor activities. -Train maintenance and operational personnel to be aware of possible activities in construction areas. -Require proper exclusion areas, signs, and notifications of potential hazardous operations on a daily basis.
LaRC	11-19-81	-Piper Advanced Technology experimental aircraft, PAT-1, crashed.	-Investigation continuing.	Three fatalities: 2 NASA; one Piper.	-Investigation continuing.

KSC	11-30-81	-Central Data System (CDS) located in Launch Control Center (LCC) was in operational mode and was being powered by Uninterruptible Power System (UPS). This unit (#3) failed and caught fire.	-UPS #3 unit input transformer failed due to thermally induced degradation of input transformer internal secondary coil insulation. -Premature failure of insulation indicates the transformer may have been operated above actual capacity. -The automatic protection provided did not protect the unit from the transformer failure.	$150K	-Provide automatic protection for UPS units from damage resulting from internal failures. -Ensure specifications of equipment are clearly defined (UPS exhaust air temp) (Transformer rating). -Fire alarm annunciator readouts be periodically field verified. -Do not overload console monitoring functions (power coordinators console, 1P9). -Preventative maintenance procedures need to cover testing of logic circuits. -Equipment shutdown procedures should be identifiable to emergency personnel.

TYPE "B" ACCIDENTS - 1981

LOCATION	DATE	DESCRIPTION	CAUSE	COST	RECOMMENDED CORRECTIVE ACTION
LeRC	02-05-81	-Failure of YJ101 engine used in PSL-4 Test Chamber during ADEN Nozzle Test.	-Unexpected failure of engine LP shaft possibly due to undetected flaw. (Note: Engine was not test article.)	78.5 K	-For use of these engines during future tests, require detailed shaft design analysis for operational safety margins and nondestructively inspect and requalify LP shaft of the engine to design.
ARC	03-09-81	-14-foot Wind Tunnel compressor blade failed.	-Crack growth originating from scratches at blade root.	$43 K	-Improved NDT procedures.
GSFC	03-13-81	-High value antennas inadvertentaly put in outside storage and damaged by scavengers. -Antennas for San Marco D.L Electric Field Experiment.	-Antennas were not in bonded storage. -No markings on boxes so they could be recognized as flight hardware. -No name of person controlling cabinet posted.	$80 K	-Provide bonded storage for flight hardware. -Provide better marking of hardware so control can be determined more easily. -Do not surplus materials without approval of custodian of materials.
GSFC	03-13-81	-Transporting recorder from building 22 to building 11. -Flat bed battery powered truck without side-rails or restraints used. -Recorder severely damaged when it fell from bed as truck turned corner.	-No side rails on flatbed to prevent load from falling. -Recorder was not restrained during transport operation. -Traveling to fast around corner.	$17.5 K	-Truck fitted with restraints. -All operating personnel instructed to secure all loads prior to transport. -Better publicity of reporting procedures recommended.
LaRC	03-28-81	-Failure of an 8-inch expansion joint in 350 psig steam supply line located in Section XII of Utility Tunnel number 1.	-Expansion joint failure was due to fatigue over a long period of time. -Failed area was highly stressed due to roller support failure.	$37.5 K	-Inspect remaining four expansion joints and replace as necessary. -Existing supports on remaining joints shall not be ceiling mounted. Fixed guide supports will replace spring loaded hangers. -Inspect 350 psig steam line bolted fasteners annually. NDE remaining expansion joints every 5 years.

LaRC	04-06-81	-A hydrogen-fueled explosion occurred in the Combustion and Mixing Research Apparatus (CAMRA).	-Check-sheet procedure error and leaking silane valve.	$50 K	-Correct check-list. -Interlock to provide fail safe condition during valve sequence check. -All wind tunnels review operations with regard to window, viewport or door trajectory in the event of an explosion. -Inspect all couplings on critical valves. Provide positive drive as necessary. -Review all facilities and ferret out like-sounding alarms.
LaRC	05-14-81	-Blade damage at 16-Foot Tunnel due to debris in airstream.	-Tunnel light glass lense came loose and severely damaged the leading edge of blade number one.	$22 K	-Install an additional retainer ring. -Provide daily inspection of lense and attachment mechanism.
ARC	05-29-81	-X-14B VTOL aircraft crashed.	-Roll control lost during test. Sideways fall of 10-15 feet.	$90 K	-Verify digital flight control systems with ground based simulation incorporating actual flight hardware and follow with in-flight verification.
KSC	06-10-81	-OPF, HB-1, Orbiter hydraulically powered up to perform fill and bleed and several problem reports. -During operation, the L/H elevon was raised to approximately 33 degrees. It hit platform 11-4 damaging 15 tiles at the inboard edge, honeycomb and structure.	-Platform should have been retracted, but was overlooked. -Inadequate walkdown inspection prior to the operation.	$10 K	-Rewrite OMI to include detailed checklist verification of elevon platform/area clearances.
KSC	07-30-81	-During removal of Thruster #R3R from right APS Pod, fuel line containing MMH was disconnected. -Fuel fell on thermal blanket directly beneath thruster and ignited.	-Disconnecting fuel line from thruster and fuel dripped from line onto thermal blanket fuel ignited.	$25 K	-Went through testing program, evaluated various fire extinquishers, and provided the most suitable. -Installed scuppers.

KSC	08-10-81	-Access stand being removed from Orbiter Columbia left hand aft lifting point when tug bumped the access stand, striking left hand end board elevon and causing damage to two tiles.	-Alledgedly, the brakes on tug failed, allowing access stands to slip into elevon.	$10 K	-Attempts to duplicate failure of brakes could not be done. -Brakes on tug had been reported as inadequate earlier on the day of incident, they had been readjusted, and the hydraulic fluid had been bled from the lines.
LeRC	09-20-81	-Fire in PSLEB Control Room during unmanned period.	-Source of ignition unknown. Probable initial fuel was protective acrylic sheet cover over control relays.	$98 K	-Smoke and/or heat detectors for all critical control rooms. -Minimize equipment powered-up when not in use. -Avoid combustible materials on relay rack and covers. -Use recognized test lab approved equipment to extent possible.
ARC	09-24-81	-Failures of supporting structures for Unitary Cooling Tower.	-Corrosion of metal tie rods.	$90 K	-The structured element (flume) that failed has been rebuilt and supporting structures repaired.
NSTL	10-23-81	-Engine fire on dump truck. -Engine, hood, cab, and fuel tank destroyed.	-Fire appeared to start at carburetor area--perhaps leaking fuel line. -Fiberglass hood contributed to fire and heat melted tank plugs and fuel contributed to fire.	$24 K	-More careful check of fuel systems following maintenance of fuel systems. -Provide fire extinquishers for vehicles in accessible location for operator.
LaRC	11-13-81	-Fire occurred in the Ljunstron air preheater of boiler Number 2 in Building 1215.	-Preheater not operated for 24 hours after clean-up and allowed oil to condense on preheater and creating fire hazard.	17.5 K	-Change procedure for initial boiler operation after preheater cleaning. -Add temperature alarm to allow early preheater fire detection.

GSFC	11-19-81	-A Wallace A-Frame Gantry Crane was placed in marginally stable condition at Thermal Vacuum Facility #225 in Bldg. 4. -Attempted to adjust A-Frame Gantry legs and gantry toppled over.	-Rigging and support inadequate. -Placing gantry in marginally stable condition then attempting to adjust legs. -Inadequate attention to task at hand.	$1.3 K and two injuries.	-Review procedures for use of A-Frame Gantry Cranes. -Review "Lessons Learned" package from LaRC A-Frame accident and fatality. -Require review of rigging and stabilization requirements for these systems. -Review safety procedures with operational personnel.

NASA AVIATION ACCIDENT/INCIDENT EXPERIENCE IN 1981

NASA's aviation safety record, accident free since 1978, was tarnished by three major accidents all apparently unrelated. The X-14 VSTOL aircraft experienced a hard landing and subsequent fire during hovering experiments. No injuries were involved. An OH-6A helicopter crashed following impact with high tension power lines resulting in the death of one pilot and injury to the other. Finally a non-NASA aircraft, the PAT-1, a novel, canard fixed-wing home built aircraft with two NASA employees and the contractor/developer pilot onboard crashed, killing all three occupants. The cause is currently being investigated. Although there was no apparent relationship between the accidents, the composite of these and other NASA accidents has renewed an effort toward increasing awareness in all aspects of safety within NASA.

NASA AIRCRAFT LOSSES

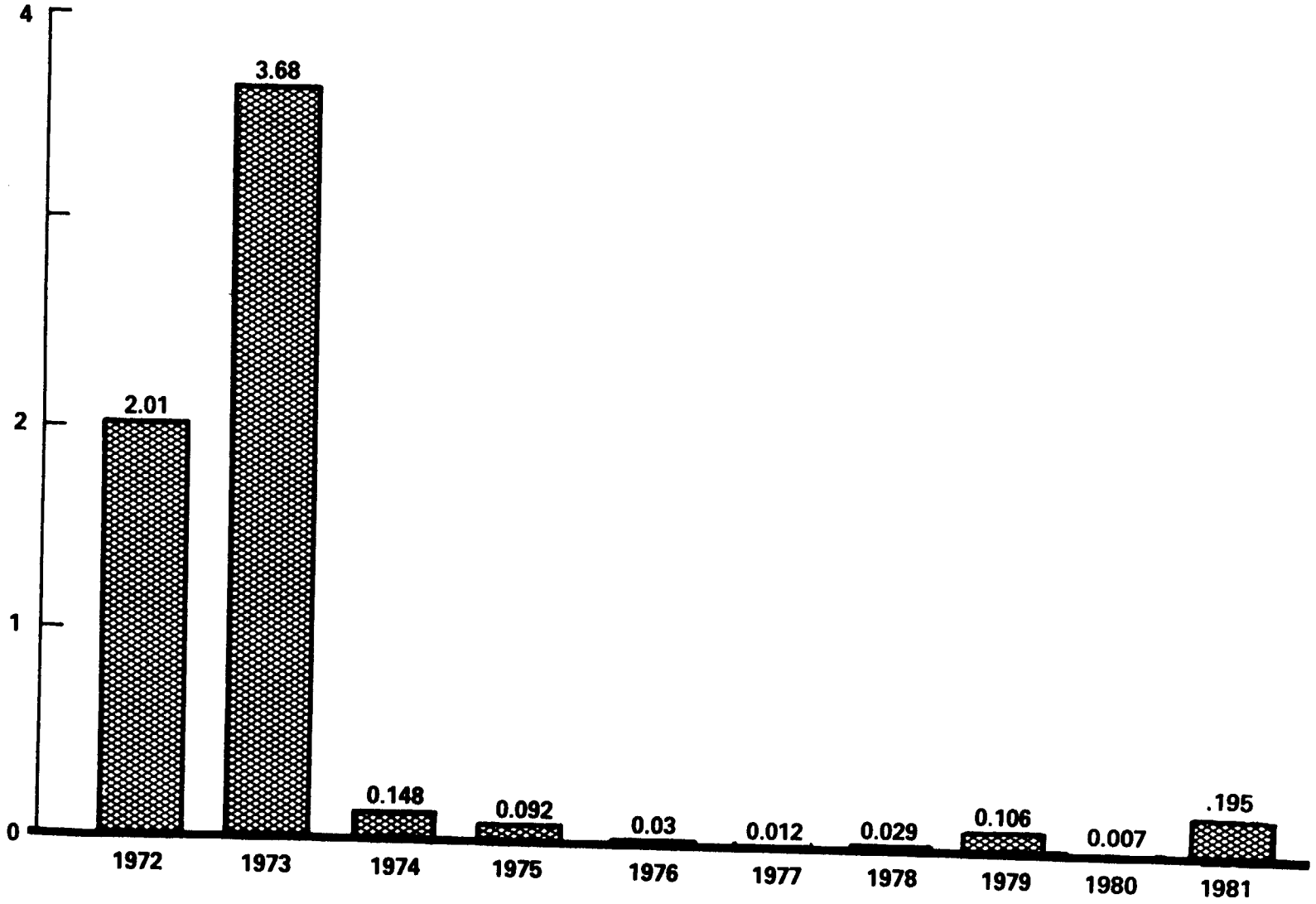


Figure 18

NASA HQ NI80-4396 (1)
REV. 5-5-82

NASA MOTOR VEHICLE ACCIDENTS

There was an increase in both the government automotive accident frequency rate and the costs of accidents for 1981. However, the goal of 5.0 accidents per million miles driven, which we met in 1973 and again in 1980, was achieved and surpassed again this year. The rate was 3.94 (up from 2.68 in 1980), and the costs were up to $10,982.

Three installations reported zero accidents while driving 1,106,000 miles in government-owned vehicles, and six installations reported zero accidents while driving 3,185,000 miles (official business) in privately owned vehicles. This is 12% and 59% percent respectively of the total miles driven.

There were 12 accidents reported for employee's private vehicles while driving 5.4 million miles for official business. There were 35 accidents to government-owned vehicles while driving them 8.9 million miles. Management is urged to continue to evaluate the driving practices and disciplinary needs to get the attention of those who do not observe traffic laws and good practices.

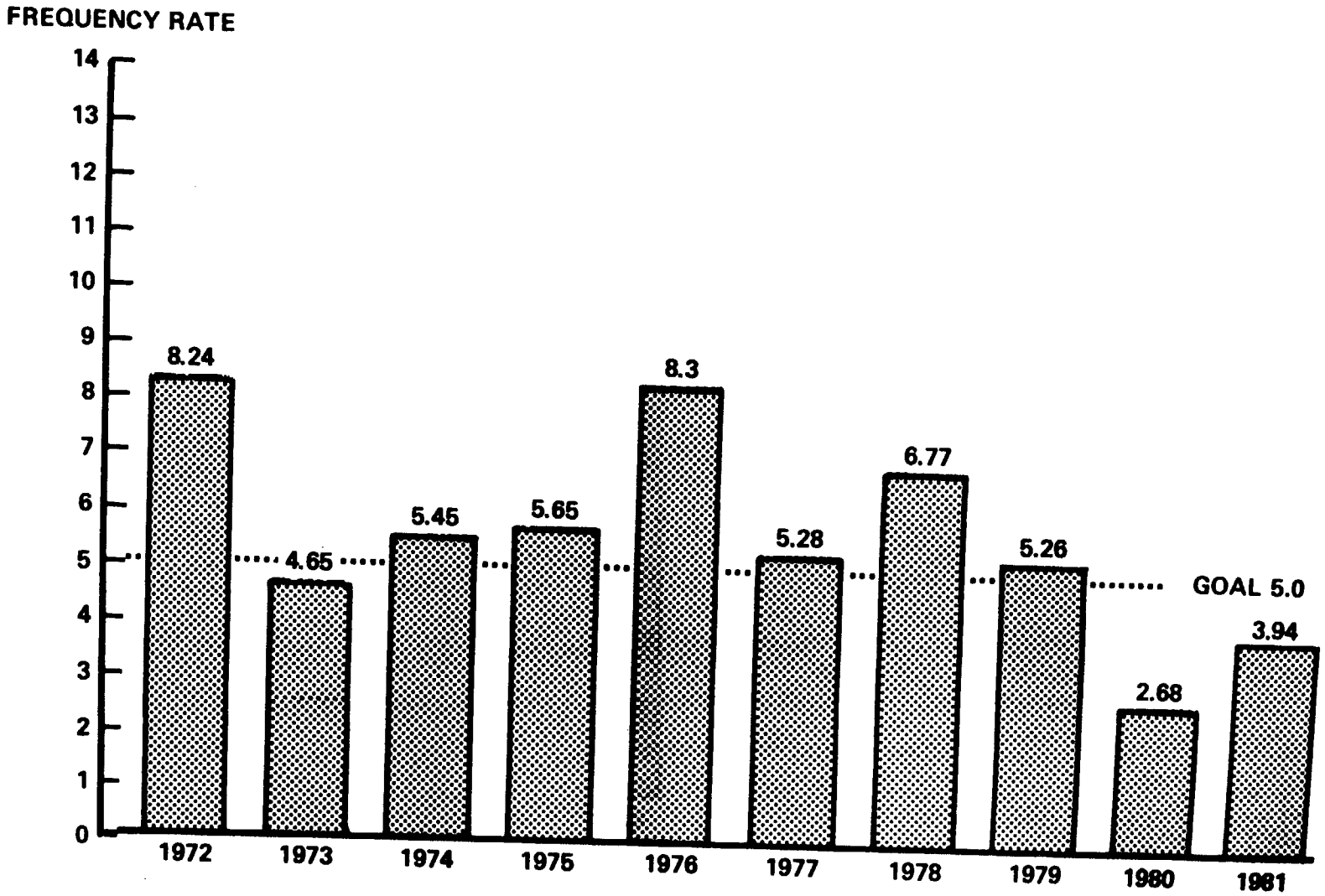
NASA 1981 MOTOR VEHICLE ACCIDENTS

Field Installations	No. of Accidents		Total Miles Driven (in thousands)		Total Cost ($)		Frequency Rate* of Accidents	
	Govt.	Private	Govt.	Private	Govt.	Private	Govt.	Private
ARC	0	0	1,086	755	0	0	0	0
GSFC	7	1	2,901	1,239	5,103	40	2.41	0.81
HQ	3	1	180	550	895	50	16.65	1.82
JSC	0	0	20	1,079	0	0	0	0
KSC	5	1	1,443	383	993	100	3.47	2.61
LaRC	1	0	614	589	200	0	1.63	0
LeRC	1	0	731	365	500	0	1.37	0
MSFC	12	0	1,915	370	3,283	0	6.27	0
NSTL	0	0	0	27	0	0	0	0
TOTALS	35	12	8,890	5,357	10,982	190	3.94	2.24

* FREQUENCY RATE IS THE NUMBER OF ACCIDENTS PER MILLION MILES DRIVEN

Figure 19
34

NASA GOVERNMENT MOTOR VEHICLE ACCIDENTS

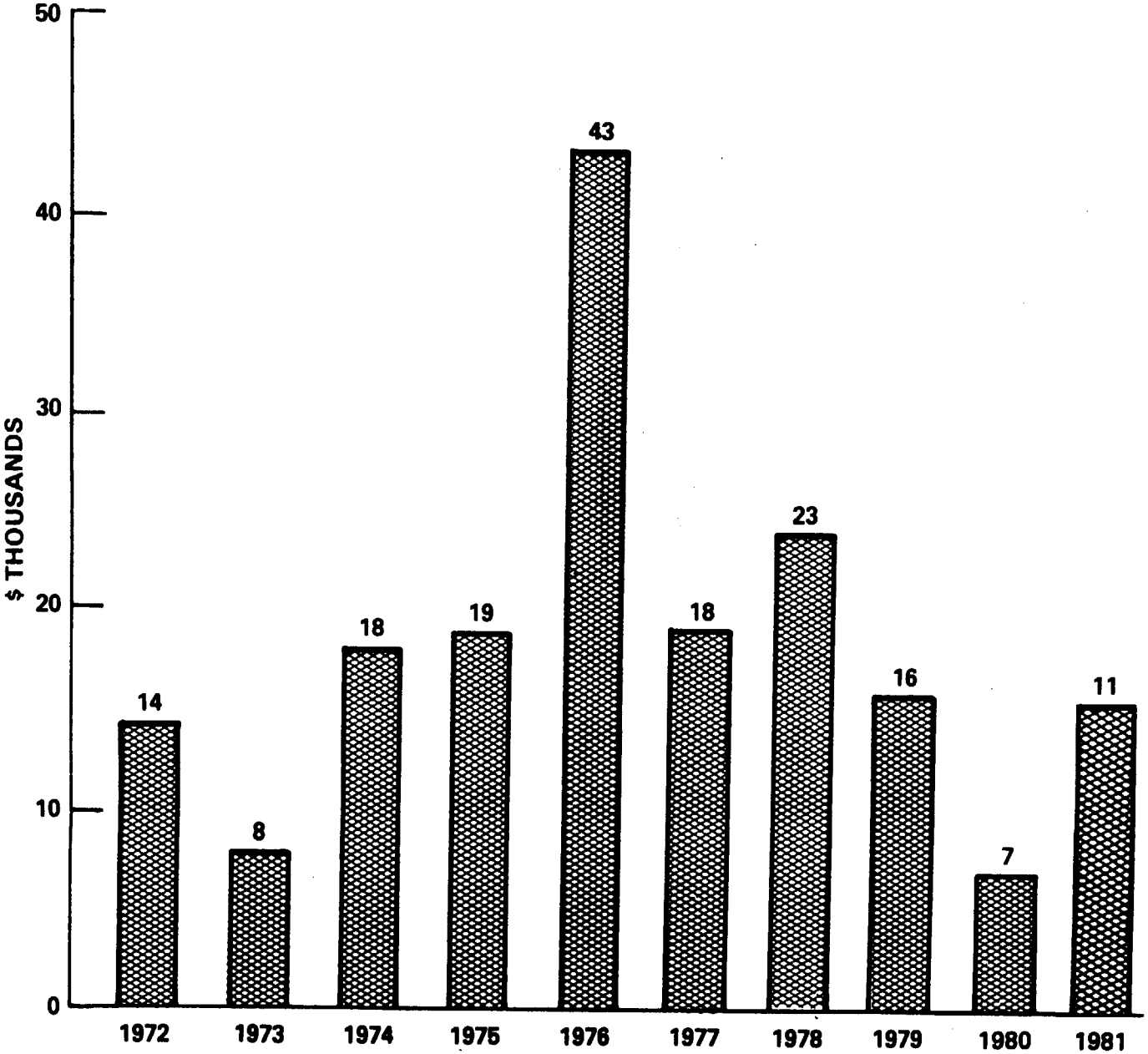


FREQUENCY RATE IS THE NUMBER OF MOTOR VEHICLE ACCIDENTS PER MILLION MILES DRIVEN.

Figure 20
35

NASA HQ N180-4387 (1)
REV. 8-6-82

NASA AUTOMOTIVE LOSSES



NASA HQ NI80-4401(1)
REV. 5-5-82

Figure 21
36

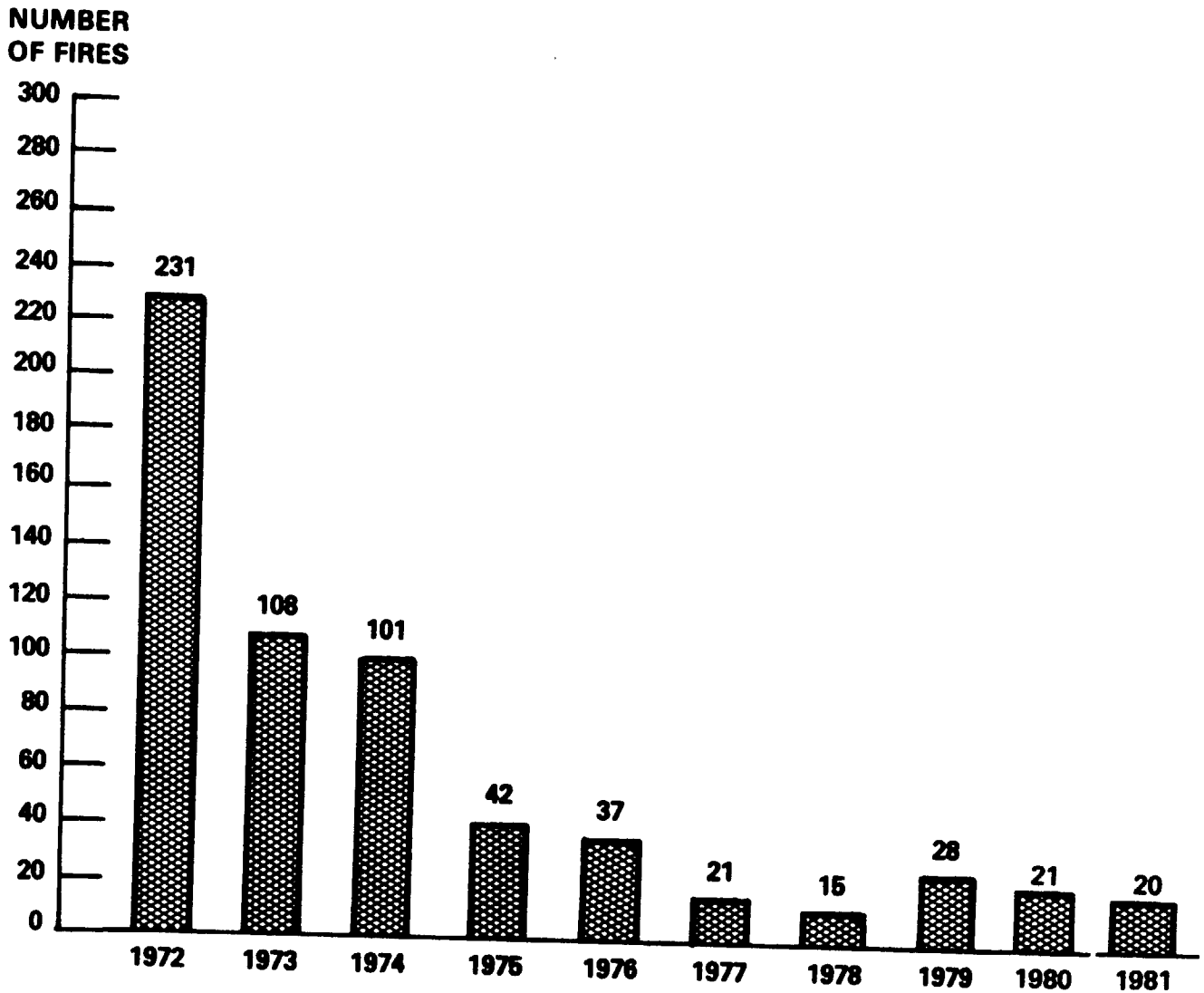
NASA FIRE EXPERIENCE IN 1981

The number of institutional fire mishaps in our facilities and equipment decreased to 20, but their costs for 1981 increased to $800,000. We continue to have reduced fire losses in buildings and facilities as a direct result of extensive fire prevention activities, excellent fire safety awareness, and a substantial investment in fixed fire detection and suppression systems.

Programs to provide fire detection and suppression systems and to require safe materials and construction must continue. These activities start in the design process and continue through all phases until project completion. Training and education of employees and professional development of fire safety personnel, should continue to be stressed. The use of balanced risk surveys help to identify major areas for improvement. These surveys provide input for our long term planning.

Although special precautions are taken during high-risk test operations, fires related to test failures still dominate our fire losses. These losses are not included in this report.

NUMBER OF NASA FIRE MISHAPS



DOES NOT INCLUDE TEST OPERATIONS
DOES NOT INCLUDE MISSION FAILURES

NASA HQ NI80-4391(1)
REV. 5-6-82

Figure 22

NASA FIRE LOSSES

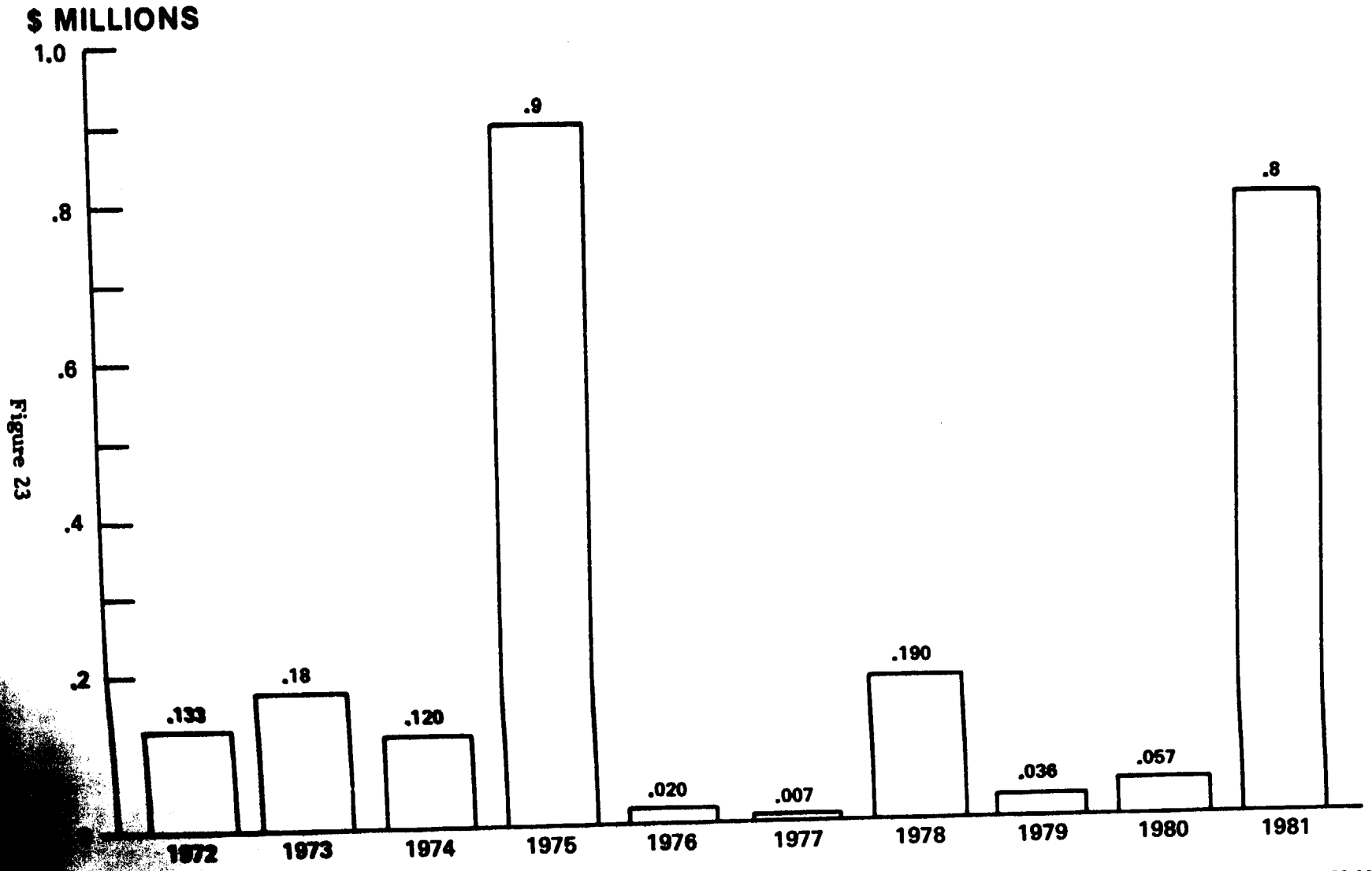


Figure 23

DOES NOT INCLUDE MISSION LOSSES OR TEST OPERATIONS LOSSES.

NASA HQ NI80-4400 (1)
REV. 5-5-82